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country at the west, and the lack of strong ties binding it to the Lower Peninsula are still apparent. The separation produced by the lakes has been intensified by the building of interstate railroads. They furnish good communication with Wisconsin and other western States. Here no barrier exists, and the economic and social interests on both sides of the line are identical. The effort to court the favor of the Upper Peninsula has always been a factor in Michigan politics. It was the long established custom of the political parties to give it the office of Lieutenant Governor and the certainty of losing this in case "Primary Reform" was adopted led to much discussion if not to serious opposition to it in that section. As was foreseen its adoption took this office from the Upper Peninsula. A substitute had to be secured in order to avoid serious disaffection, and that substitute was found in the office of Superintendent of Public Instruction. This illustrates the human response to geographic and economic environment. The activities of a government may be extended over an area within boundary lines arbitrarily drawn, but the establishment of those lines does not make a united people. Few States of the Union are economic units hence their government is a compromise of diverse interests.

THE HEMPSTEAD PLAINS

A NATURAL PRAIRIE ON LONG ISLAND

BY

ROLAND M. HARPER

It does not seem to be generally known, even to geographers, that there is in the western third of Long Island, within an hour's journey by rail from New York, about fifty square miles of dry land which was treeless when the country was first settled, and that a considerable part of this can still be seen in its natural condition. This prairie, known locally as the "Hempstead Plains," is mentioned in a few historical and descriptive works, but long before geography became a science it had ceased to excite the wonder of the inhabitants and travelers, few of whom at the present time realize that there is not another place exactly like it in the world. Its influence on local geographical nomenclature is shown in the names Plainview, Plain Edge, Island Trees and East Meadow Brook.

The earliest description of this geographical curiosity which I have heard of occurs on page 241 of "A Tour in the United States of America," by J. F. D. Smyth, Esq., published in Dublin in 1784. There are several interesting references to it in the two editions of B. F. Thompson's History of Long Island, published in 1839 and 1843, especially the second. My attention was first called to it by the following statement in the U. S. Department of Agriculture's "Soil survey of the Long Island area," by J. A. Bonsteel and others:—* "The . . . Hempstead plain is notable in being a natural prairie east of the Allegheny Mountains. In its natural state it bears a rank growth of sedge grass. It was treeless when first discovered and was originally used as commons for the pasturage of cattle and horses belonging to individuals and to communities."



FIG. 1.—Looking east across dry valley at Hempstead Brook, east of Garden City, showing treeless horizon about $\frac{1}{2}$ mile away. No traces of cultivation in this view. Sept. 29, 1909.

The same thing has been mentioned incidentally in the catalogues of Isaac Hicks & Son, nurserymen of Westbury, L. I., and in "Long Island Illustrated," an attractive booklet issued annually by the Long Island Railroad.* In "Forest and Stream" for Aug. 15, 1908, I published a preliminary note on the subject, illustrated by a photograph.

For a generation or more the Hempstead Plains have been known to a few botanists as a good collecting ground, and every one who has traveled from New York to Cold Spring Harbor by rail, since

* Field operations of the Bureau of Soils for 1903, p. 99; or p. 13 of the "advance sheets" for this particular area, published in January, 1905. A somewhat similar statement occurs 27 pages farther on. I am also indebted to Dr. Bonsteel for the reference to Smyth mentioned above.

† On page 19 of the 1907 edition it is stated that "Through the centre [of the island] will be found stretches of meadow blending into prairies of the western type"; but this statement does not appear to be in some editions a few years earlier.

the establishment of the Brooklyn Institute's biological laboratories there, has passed through several miles of what was once prairie, and seen a little which is still in its natural condition; but to this day the real nature of the area in question has apparently never been mentioned in botanical literature. Previous to the summer of 1907 I had been along the edges of the area, as defined by Bonsteel, in several places, and penetrated into it for short distances, without seeing any natural vegetation, so I supposed that the prairie was all occupied by villages, private estates, farms, etc., and that it was consequently no longer possible to verify the published statements about its original vegetation. But one day in July of that year I happened to cross the center of the area on foot, and was surprised to find that there are still thousands of acres on which the flora is practically all native. This is pretty good evidence that such areas



FIG. 2—Looking W. N. W. in dry valley near southeastern corner of Hempstead Plains, showing a few small oaks and birches along the horizon. Sept. 19, 1909.

have not only never been artificially deforested, but also never been touched by the plow. Where the sod is once broken a very different flora, consisting largely of European weeds, comes in, so that areas which have ever been cultivated can be distinguished at a glance. The same is true to some extent of areas that have been too closely grazed.

The prairie occupies the central portion of Nassau County, about midway between the north and south shores of the island. Like the pine-barrens of Suffolk County, a few miles farther east,* it lies entirely south of the latest terminal moraine (the Harbor Hill moraine), but partly overlaps or dovetails into the older of the two Long Island moraines (the Ronkonkoma moraine). Originally it extended westward to where Floral Park now is and eastward to

* *Torrey*. Vol. 8, p. 2. 1908.

Central Park, a distance of about twelve miles, and had its greatest breadth from north to south of about seven miles very near its eastern end. North of the straight main line of railroad from Floral Park to Hicksville, and also west of Garden City and Hempstead, the original prairie vegetation has been almost totally obliterated; but a little south of Hicksville there are still a few places where one could describe a circle a mile in diameter without including a tree or a house or a field. Probably about one-fifth of the original prairie area is still in its natural condition, except for being intersected by roads.

The surface of the Hempstead Plains, like the rest of the southern or unglaciated portion of Long Island, is for the most part very flat, and slopes gently southward at the rate of about one foot in 300. It ranges in altitude from about 60 to 200 feet above sea-level. Traversing the plain in a general north and south direction are a number of nearly straight broad shallow valleys, ten to twenty feet in depth, which are believed by geologists to have been formed by glacial streams and not by recent erosion.* Within the limits of the prairie most of these valleys are now dry at all seasons, but farther south some of them contain permanent streams.

The soils of the area under consideration were described and mapped by Dr. Bonsteel's party, in the report already cited, as "Hempstead loam" and "Hempstead gravelly loam."† The former, which covers much the greater area, is a fine-grained loam, of a color which might be described as chocolate-drab, full of tough roots of grasses and other herbs near the surface, and passing rather abruptly at a depth of a foot or two into a coarse quartz sand and gravel of unknown depth. The "gravelly loam" phase is where the gravel comes to the surface, and it is chiefly confined to the slopes of the valleys above described.

Mechanical analyses of these soils are given in the government publications cited. Dr. E. W. Hilgard has kindly examined for me a sample of the "Hempstead loam" collected about a mile southeast of Hicksville in 1908, and finds it to consist almost entirely of clean quartz grains, with 1 per cent. of humus, .03 per cent. of lime (this in acid combination with the humus), and .04 per cent. of phosphoric acid ($P_2 O_5$).

* A. C. Veatch, *Prof. Paper* U. S. Geol. Surv. No. 44, pp. 47, 52. 1906.

† In another publication of the Bureau of Soils, issued about the same time ("Instructions to field parties, and descriptions of soil types. Field season, 1904." Page 61) it is stated that the gravelly loam should have been mapped as Hempstead loam with gravel symbol; and the same statement is repeated in subsequent editions of this handbook.

Outlying areas in Kings and Suffolk Counties, mapped as "Hempstead loam" in the same report are now almost entirely under cultivation, and I know of no evidence that they were ever prairie.

The upland vegetation of the Plains comprises about four species of trees, a dozen shrubs, sixty herbs, and a few mosses, lichens and fungi. The commonest tree is gray birch (*Betula populifolia*), which in this region is oftener a shrub than a tree, and the other trees are two oaks (*Quercus Marylandica* and *Q. stellata*) and a pine (*Pinus rigida*), which are scattered sparsely over the eastern part of the area. The shrubs also are most abundant eastward. One of them is a willow (*Salix tristis*) and two are oaks (*Quercus ilicifolia* and *Q. prinoides*), and nearly all grow less than knee-high. The commonest herb is broom-sedge (*Andropogon scoparius*), a species of grass, which is said to be also common on some of the western prairies. The herbaceous vegetation, which is almost the only vegetation between Hicksville and Hempstead, with the exception of a ubiquitous shrub of the heath family (*Pieris Mariana*), covers the ground pretty closely except in the most gravelly areas, is nearly all perennial, and averages about a foot in height.

Although the prairie vegetation grows in comparatively dry and sour soil, and gets about all the sunshine and wind there is in those parts, it exhibits no extreme xerophytic adaptations. A good many species, including several of the most abundant ones, have decidedly canescent foliage, and about half as many are glaucous, so that the whole landscape has rather a grayish tint. A large proportion of the species have very narrow leaves, but there are no succulents, and very few evergreens. On the other hand there are of course no very large or thin leaves.

Most of the trees and shrubs bloom in spring and most of the herbs in late summer. Most of the woody plants and about one-sixth of the species of herbs are wind-pollinated. Most of the colored flowers are either white, yellow or purplish, and none of them are very large or noticeably odoriferous. Wind is naturally the chief agent of dissemination, but the scarcity of berries and the complete absence of burs, in a region so accessible to birds and mammals, is a little surprising.

The dry prairies just described cover something like 99 per cent. of the area. The principal stream in the Plains is East Meadow Brook, which begins gradually, at an indefinite point varying with the wetness of the season, in one of the valleys about three miles east of Mineola and Garden City, flows nearly due south, and enters the woods about a mile from its source. Next in importance is Hempstead Brook, which flows right through the town of Hempstead. It takes its rise in a narrow strip of meadow just above the town, and its dry valley can be traced for a few miles to the north-

ward. Still farther west there are one or two smaller streams similarly situated and bordered originally by similar vegetation, but now considerably encroached upon by civilization. The wet meadow vegetation along these streams when viewed at a little distance does not differ much in aspect from that of the dry prairies, except that it is taller, many of the shrubs being as high as a man's head and the herbs knee-high. The species in the two habitats are of course almost entirely different, but their numbers happen to be about equal.

This prairie was originally bordered all around by forests, mostly of the oak type, but the border-line has been nearly everywhere obliterated by civilization, as it was a very attractive place for farms when the country was first settled, the woods on one side furnishing fuel, building material, good soil, protection from wind,

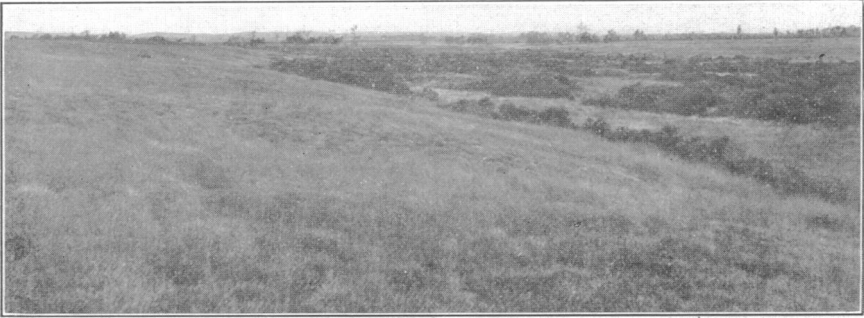


FIG. 3—Looking up the valley of East Meadow Brook from a point about $2\frac{3}{4}$ miles east of Garden City. Hills of the Harbor Hill moraine in the distance. Except for a few scattered shade-trees, half a mile or more from the camera, this scene probably looks just as it did a thousand years ago. October 27, 1907.

etc., and the prairie on the other furnishing a good range for stock and an open place for buildings, etc., without the labor of clearing. At some places south of Hicksville only a single row of fields at present intervenes between the "Hempstead loam" prairie and the "Sassafras gravelly loam" oak forest, but in most places the original boundary of the prairie could now hardly be determined within half a mile. Before the country was settled the oaks were presumably encroaching on the prairie from all sides. But in the few places where pine forests border the prairie I have never been able to determine which way the tension-line is tending to move.

The cause of the treelessness of prairies has probably been discussed in geological, semi-popular, and non-botanical literature more than any other strictly botanical problem, and perhaps even

more than it has by botanists but no explanation has yet been found to fit all cases. Some of the partial explanations which have been suggested for the well-known prairies of the upper Mississippi valley will apply as well to the one under consideration, and some will not.* In a paper of such limited scope as this it would be out of place to attempt to review all the prairie theories, or even to mention all who have speculated on the subject; and only the briefest summary can be given here.

Among the western prairie theories which will not apply on Long Island are deficient rainfall, extreme variations of temperature, and impervious subsoil. The only previous attempt to explain the Long Island prairies (at least in print), that of Dr. Bonsteel, does not fit much better. In his soil survey report above mentioned he seems

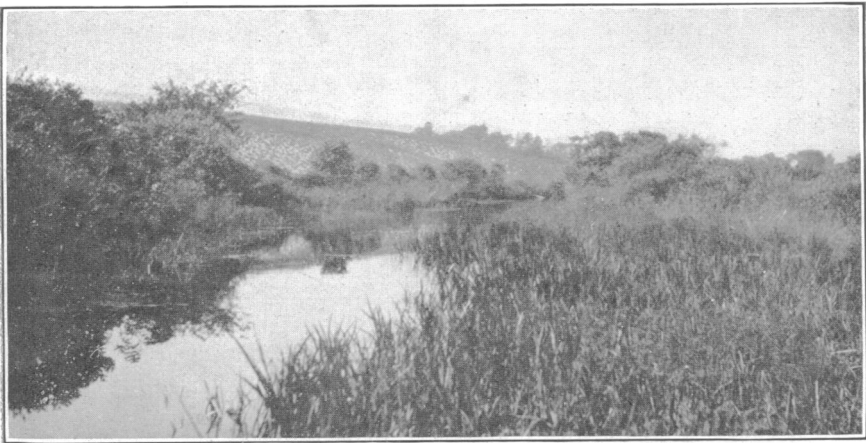


FIG. 4.—Looking up slough at western edge of valley of East Meadow Brook, $2\frac{3}{4}$ miles east of Garden City. Gravelly hillside at left. Sept. 29, 1909.

to imply that the absence of trees is due to the coarse dry gravel which underlies the whole area; a condition which is just the opposite of that found in some of the Illinois prairies. But within a few miles of our prairie there are soils still more gravelly and arid which are well wooded.

Our prairie is subject to a good deal of grazing, frequent fires, strong wind, and excessive evaporation, like the western ones, but these factors are the result rather than the cause of treelessness, so that they could hardly have determined the prairie in the beginning or fixed its present boundaries.

* The interesting papers of Shimek (*Proc. Ia. Acad. Sci.* Vol. 7, pp. 47-59, pl. 4. 1900) and Gleason (*Bull. Torr. Bot. Club.* Vol. 36, pp. 265-271. 1909) should be examined in this connection.

There are two suggestions that have been made with regard to the prairies of the Middle West which deserve more notice, though each leaves much to be explained. Alexander Winchell in 1864* summed up the opinions of most of his predecessors on the subject, indulged in some curious and perhaps not altogether essential observations on the vitality of buried seeds, and concluded that the "prairies were treeless because the grasses first gained foothold and then maintained it." The same idea has recently been expressed more elaborately by L. H. Harvey.† Prof. J. D. Whitney in 1876‡ distinguished between the arid plains toward the Rocky Mountains and the relatively humid prairies near the Mississippi River, showed the inadequacy of climatic theories to account for the latter, and pointed out that all such areas known to him were characterized by essentially horizontal strata, level surfaces, and finely divided soil. He distinguished between cause and effect, unlike some others who have written on the subject, but admitted his inability to show a causal relation between the conditions he described and the absence of trees. What he said about the topography and soil of the western prairies applies almost as well to those of Long Island§ (which he probably knew nothing about), and even to some other kinds of treeless areas, such as wet meadows and salt marshes.

Although the prairies of Long Island are closely correlated with a certain type of soil, it is still an open question whether most of the peculiarities of prairie soil, here and elsewhere, may not be due to long occupation of the same ground by herbaceous vegetation. In its mechanical analysis, and even in its color, the "Hempstead loam" strikingly resembles the "Galveston clay" (an arbitrary name for a well-known type of soil, the salt marsh) described in the same government soil report; but it is probably a little too early to jump to the conclusion that the area in question was once a salt marsh while adjoining areas were not.

Not the least interesting fact about this unique insular coastal plain prairie is that so much of it is still in a state of nature, although it is situated in a county which has been settled for 250 years and has about 300 inhabitants to the square mile, and is all within the zone in which it is profitable to haul farm products to New York by wagon. This state of affairs is probably due to a combination of several more or less independent causes. Good

* *Am. Jour. Sci.* Vol. 88, pp. 332-344, 444-445.

† *Bot. Gaz.* Vol. 46, pp. 86, 297. 1908.

‡ *Am. Nat.* Vol. 10, pp. 577-588, 656-667.

§ Mechanical analyses of the "Hempstead loam" by the U. S. soil people show that about 76 per cent. of it consists of particles less than $\frac{1}{20}$ of a millimeter in diameter, and that less than 3 per cent. of it is in particles exceeding a millimeter.

crops are raised on the parts that are under cultivation—with what margin of profit I have not ascertained—but the toughness of the sod, the thinness of the soil, and especially the scarcity of water, doubtless operate strongly to keep away new settlers unused to such conditions. The prairie farms have probably been handed down from father to son for generations, and the newcomers in the county (most of whom now come from the city or from Europe) are mostly settling in the villages, where they are independent of many of the local geographical conditions. That tradition has had a good deal to do with the preservation of the prairie is suggested by the following passage in the second edition of Thompson's History of

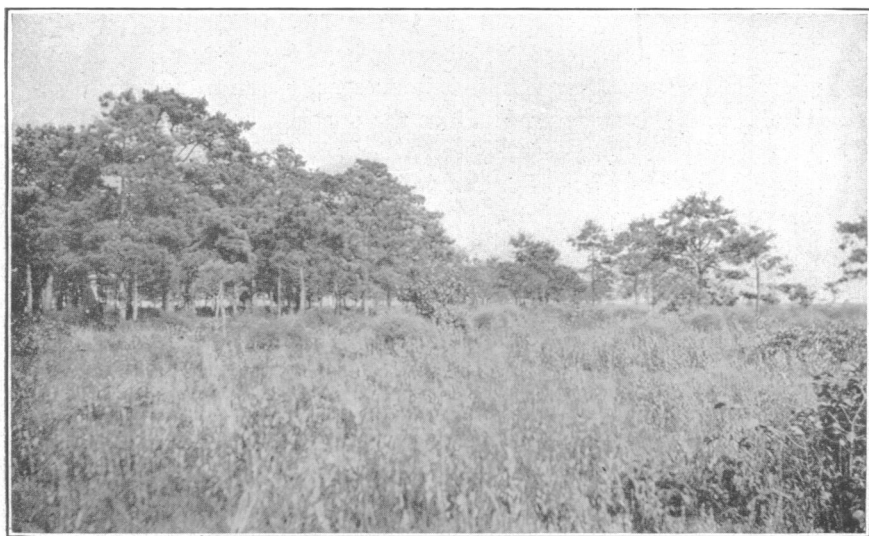


FIG. 5.—Edge of small grove of pitch pine (*Pinus rigida*) in prairies about a mile southwest of Central Park. Aug. 25, 1909.

Long Island (Vol. I, p. 29, 1843), which would be almost equally true today:

"If the whole of this open waste was disposed of and inclosed in separate fields, the agricultural products of this portion of the island would be nearly doubled. A stupid policy, consequent upon old prejudices, has hitherto prevented any other disposition of it, than as a common pasturage. It is hoped the time is not far distant, when this extensive tract shall abound in waving fields of grain, yielding not only support, but profit, to thousands of hardy and industrious citizens."

It is said that A. T. Stewart, the merchant prince, when he founded Garden City and built a new railroad across the Plains,

about forty years ago, bought out the town's remaining interests in this land for \$55 an acre, and that a large part of it is still held by his heirs and leased to wealthy people living in the vicinity, who find it a splendid place for various equestrian sports in which they have long been accustomed to indulge. For several years past automobile races have been held on the better roads of this exceptionally level area, and the year 1908 saw the beginning of the "Long Island motor parkway" in this area, an undertaking which was no doubt facilitated by the scarcity of trees and farms. Still more recently the Hempstead Plains, for the same reason, have attracted considerable attention as the scene of a number of experiments in aeroplane flight.

Even if no more of this land were taken up in farms, the continued growth of New York City is bound to cover it all with houses sooner or later, and it behooves scientists to make an exhaustive study of the region before the opportunity is gone forever. Zoologists as well as botanists would find much to interest them here. According to Dr. W. C. Braislin* the Hempstead Plain was once the home of the heath-hen, which is now making its last stand on Martha's Vineyard. At the present time several other birds which are infrequent elsewhere, especially certain sparrows and larks, find a congenial habitat on the prairie, and insects, especially grasshoppers, are quite abundant at the proper seasons.

No one seems to have yet attempted seriously to enumerate, classify and explain the numerous and various treeless areas of Eastern North America. If this were done perhaps other areas similar in character to the one described might be found. There are abundant hints of small prairies, open glades, natural meadows, etc., in early descriptive works dealing with parts of the country that are now pretty thickly settled, and many examples of them have doubtless already been effectually obliterated, and irrevocably lost to science.

* *Abstr. Proc. Linn. Soc. N. Y.* Vol. 17-19 (1904-1907), p. 66.